lic taste grows indifferent, and gentle harps are struck altogether in vain. We want some one to come forward in the spirit and power of Cowper, who shall speak in a voice which shall compel the world to listen,—and in a voice too, which religion and virtue, as well as literary taste, can hear with applause. We are confident that such an one will appear; whatever may be said of new directions given to the mind in this self-complacent age, so long as the mind exists, it will treasure poetry as an art which does much to exalt it; there never will be a time when cultivated minds will cast this pearl away. It may be valued at some periods more than at others: it may be less regarded now, than it has been in former times; but these are only transient and passing changes; it will survive them all, and will last as long as the world endures.

Art. II.—*Decandolle's Botany.*

1. *Théorie Elémentaire de la Botanique, ou Exposition des Principes de la Classification naturelle,* &c. Par M. A. P. Decandolle. Seconde Edition, revue et augmentée. Paris. 1819.
2. *A Grammar of Botany, illustrative of artificial, as well as natural Classification, with an explanation of Jussieu's system.* By Sir James Edward Smith, H. D. President of the Linnæan Society, &c. London and New York. 1822.
3. *Introduction to the Natural System of Botany: or a systematic View of the Organization, Natural Affinities, and Geographical Distribution of the whole Vegetable Kingdom.* By John Lindley, F. R. S., L. S., G. S., Professor of Botany in the University of London, &c. First American Edition, with an Appendix. By John Torrey, M. D. New York. 1831.

The botanical student, who has rambled over mountain and marsh, with a box under his arm, and a bundle of grass or a shrub in his hands, must have been conscious how like one demented he often appeared to the unlettered rustics; and while the query, so invariably put to him, '*What is that good for?*' received no satisfactory reply, how plainly their looks,

more expressive than language, told him, that he had better stop gathering good-for-nothing weeds, and take to some honest and profitable employment. This thing is too common to be wondered at, and is moreover easily enough explained on the ground of ignorance of any end or object in science, save that of the most direct practical utility. But how is it to be accounted for that men, whose education and intelligence, we should suppose, must have carried them beyond such unworthy views of the nature of science, too often entertain notions respecting botany, as confused and mean as those of the most uncultivated mind? Why is it, that they can look on the plants of the field, clothed in the rich garniture of a summer month,—in spite of the beauty that allures their gaze, and the admirable arrangement of organs, whereby the whole economy of vegetation is maintained,—without receiving any uncommon ideas of wisdom or power, and perhaps turn away from them all, as unworthy of a passing notice? Why is it that they can hear of the labors of botanists, of their travels by sea and land, amid suffering and privation, with no other effect, perhaps, than to call up more vividly to their imagination the picture of Obed Battius, or some other equally miserable caricature of enthusiastic devotion to a favorite science?

The truth, indeed, is too obvious to be questioned, that botany does not bear that character of dignity and importance in the public view, which has long since been obtained by many other of the natural sciences. This may be sufficiently explained,—at least, we know nothing else that can explain it,—by the single fact, that very little has been done by its friends towards introducing to general attention the more elevated and philosophical portions of the science,—those only that can make it respectable with thinking and well educated minds. When a person lights upon a botanical book, and finds it,—as nineteen times out of twenty he will find it,—a catalogue of hard names, followed by still harder descriptions in an unknown tongue, or it may be designed for juvenile minds, and of course presenting nothing to him very striking in point of novelty or importance, it is not to be wondered at that he should imbibe no favorable impressions concerning it. From such we might reasonably expect to hear the complaint, that botany has furnished none of the useful and astonishing results of chemistry; that it gives rise to none of those grand and over-

powering conceptions, which the study of astronomy crowds upon the mind; that we find in it little of the strong dramatic interest, so powerfully awakened by the changing scenes of creation and destruction which geology displays. In short, however well calculated its study may be considered to arrest the attention and induce good habits of observation in the young, or to afford those of riper age a pleasing relaxation from other pursuits, it is too commonly regarded as destitute of those general views and profound discussions that require much thinking, or the exercise of a severe and precise logic. It may be said, and no doubt with justice, that such erroneous notions are the fault of those who entertain them, and that little knowledge of any subject can ever be expected, if a man can be turned from its pursuit at the first appearance of a technical word, or confine himself to the pages of a school-book. This may be true enough, but it is our business at present to show the cause of this prejudice, not its unreasonableness.

The books; that are put into the hands of beginners in this country, contain chiefly the merest elementary descriptions of the organs of plants, and perhaps a meagre account of their functions; being written by persons who are incapable, from their limited attainments, of conveying the slightest idea of the more elevated parts of the science. Books of a higher order, we know, have been occasionally published here; but without a single exception that we can think of at this moment, they have been the productions of authors who have not attained the highest rank in the science, nor been duly sensible of the advances made in it by others. While the works of Sir J. E. Smith have found editors and publishers with us, the masterly writings of Decandolle and Brown have been suffered to remain under the veil of a foreign or dead tongue, unheard of by the great mass of botanical students. Had half the efforts been made to present the science in a light at all worthy of its real merits, that have been used in teaching words, or disseminating loose and superficial views, its pretensions to a high character would long since have been seen and acknowledged. We should not now be obliged to say, at the risk of being suspected of exaggeration, that no science is more distinguished than botany for the enlargement and permanence of its general views, for the strictness and accuracy of its reasonings, for the sure and cautious deductions on which its great principles are established,

for the demonstrations of the harmony and contrivance with which the organic world is ordered, and especially for a spirit of patient and profound philosophy, which alone can confer upon a science real dignity and value. To obtain a rank among the most distinguished botanists of the present day, demands not only long and laborious investigation, but the exercise of talents that belong to the highest order of mind; for the relations to be discovered, and the principles to be deduced, must be the result of profound and untiring reflection. The laws whereby the vegetable economy is regulated, those which govern the affinities and differences of its various members, their distribution over the surface of the earth, and their connexion with the physical agents around them, are just beginning to be discerned, and their study will long present a field of inquiry, in which the most philosophical genius may find ample scope for the exercise of its powers. The whole end of botany is not accomplished, when we have accurately described the characters of plants by which they are distinguished from one another, and given them a name and a place in the great register of nature; for we are thereby furnished with no better knowledge of the *plants themselves,* than we could obtain of the propensities and mental faculties of a runaway, from the advertisement that describes his clothes and person. Neither does the branch of physiology which teaches us the functions and general economy of plants, furnish us with that particular knowledge of *the* plant that we wish, any more than the most intimate acquaintance with metaphysics or human anatomy would enable us to pronounce at sight upon the mental or physical habits of an individual man. The noblest end of botany, now, is to ascertain the points of resemblance and difference between plants, which associate them with and remove them from one another, to trace the progress of organization through all its gradations from its lowest to its highest forms, in short, to lay open the operation of all the causes which modify the conditions of their existence. This is that *philosophy of botany,* to the advancement of which the most eminent in its pursuit are directing their utmost efforts, and some more adequate notions of which are necessary to gain for it the general respect that it really deserves.

The great, the essential preliminary towards the attainment of this end,—if indeed it may not be more properly considered

as comprising the end itself,—is to improve our classifications; for these involve so many considerations,—have reference to so many points in the history of the plant,—that when it is once fixed in the place to which it most naturally belongs, we are thus made acquainted with the most valuable knowledge concerning it, always excepting its practical uses, which are determined by experiment. Had this truth been generally recognised, and made the basis of improvement in botanical science, we should now be spared the regret that we experience, while looking back on its progress, to see how much labor and zeal have been expended on points of comparatively small or secondary importance, to the neglect of those that deserved the first and closest attention. We should not have to deplore that common misapprehension of the true nature and purposes of botanical classification, which has given rise to a fatal jealousy among men zealously devoted to the cultivation of the same pursuit, and lain like a blight on the growth of this beautiful science. While the number of described plants was small, and those but imperfectly known, the only motive that led to their systematic arrangement was the greater convenience it afforded of ascertaining their names, and, in the facilities which it supplied for this object, consisted the sole merit of the arrangement. The principle thus laid down, and which was well enough in the commencement of the science, continued, however, to maintain all its force long after the accumulated results of discovery demanded more ample and accurate information, more enlarged views, and a spirit of philosophizing that should concern itself with things rather than words. And what is stranger still, after this kind of classification had been carried to its highest possible degree of perfection, and every thing been accomplished by it that could have been anticipated, it was looked upon as rendering any other on different principles and for different purposes altogether unnecessary, and all that remained for botanists was to add to the existing heap of crude and barren materials. The object indeed was an important, an indispensable one, and the mind that best accomplished it was one of no ordinary capacity, but after all, it is only a means and not an end, for which it seems to have been generally mistaken.

It is to be understood, that the difficulty under which naturalists labored for a long time, and which operated as a serious check on the progress of science, was the want of a system, whereby

the contributions to the common fund of information could be easily arranged and readily referred to by others. Without this their researches were almost vain, and their results unprofitable. The same necessity still continues. Fifty thousand species of plants have now been discovered, every one of which has been examined, its characters set down, its relations unfolded, and of many, the properties and uses have been ascertained. But how is this knowledge to be referred to? With one of this immense multitude in our hands for the first time, how are we to ascertain a single fact concerning it, without previously making ourselves acquainted with its *name?* What clue is to guide us through the vast labyrinth of genera and species, and bring us at last to the very plant in question? Some system of arrangement or classification, of course, is the only thing that will remove the difficulty, and those that have been constructed in direct reference to this point, viz. for ascertaining the *names* of plants, are called *artificial* or arbitrary methods, in contradistinction to the *natural* methods founded on the relations of plants, and indicated by nature itself. Each of these methods has distinct and peculiar purposes of its own, and when these are understood and clearly kept in view, there cannot be a question with those in the least qualified to judge, that both have a utility that is indispensable to the interests of the science. Simple and intelligible as this appears, yet an unaccountable delusion seems to have prevailed, that they are not merely different from, but opposed to each other; that their ends are the same, but attained by different routes; that their merits are conflicting, and are to be weighed in the same scales together. Opposition, jealousy, and party-spirit have thus been excited, where naturally no foundation for them ever existed in difference of opinion or interest.

Bearing in mind the fact above stated, that in the artificial method the object is merely to ascertain the names of plants, we, of course, should not expect to find them arranged according to their general affinities, for a single organ may be assumed, and the differences which it presents in different species be made the basis of the classification. Thus, if we class plants according to the form, absence, presence, or some other condition of the corolla, with Tournefort, or of the stamens, with Linnæus, we shall bring species together, agreeing in respect to these organs, while in every other particular, there

may be the utmost possible difference between them. Plants, between which the most obvious family likeness exists, may be torn asunder, and placed in classes far remote from one another, the object being not to ascertain relations but names. Though any part or quality of the plant may be made the basis of this method, yet its design will be best fulfilled when this basis is something inherent in the plant, easy to be observed, found in the greatest number of plants, and presenting sufficient variation in different species to make it easily and clearly expressed. The artificial methods were exceedingly defective, and about as numerous as the botanists who used them, till Linnæus, after devoting all his energies to their improvement, finally succeeded in constructing one which superseded every other, and has maintained its superiority to the present day, unrivalled and undisputed. Considering the stamens as uniting the conditions just mentioned to the greatest extent, he fixed upon these organs as the ground of his classification, and certainly no man, starting from a single idea, was ever conducted to more brilliant and durable results. His first eleven classes were founded on the number of stamens; the two next, on their insertion; the two next, on their comparative length; the five next, on their union; the three next, on their separation from the pistils; and the last, on their absence or obscurity. The remarkable facility which this method afforded for ascertaining the names of plants, and its admirable flexibility under difficulties, were so strongly contrasted with the deficiency and awkwardness of all previous contrivances, that we cannot wonder at all at the universal acclamation that greeted its announcement, or the hearty tribute of homage and thanksgiving bestowed upon its author. And still we ought not to forget the numerous other circumstances, that contributed at the time to give popularity to the new system. Within a short period of its appearance, the rapid progress of discovery had made the defects of other systems more apparent and onerous than ever; the credit of discovering the functions of the stamens had just been given to its author; science was incalculably benefited by his introduction of specific names and characteristic phrases, and in his hands botanical nomenclature was endowed with a precision and force it had never before known. Add to this, that he had rendered important services to every other branch of natural history; the whole domain of nature had been subject to his researches, and he had

every where left the impressions of his comprehensive mind. We mention this, not in disparagement of the sexual system, for we have no wish to detract in the slightest degree from its merits, but in order to account for the common disposition of its followers to give to it merits that it neither does nor can possess, and pertinaciously to claim for it an end never thought of by its author himself. It is not the first time that a man, who has done one thing well, has been supposed by his over-fond friends to have accomplished every thing.

In the natural method, plants are arranged according to their natural relations; those being associated together, which most nearly resemble one another in the whole of their structure and appearance. They are expected to agree not in one particular only, but in many; all minute and trivial characters are disregarded, while the prominent and striking features, being indicative of family resemblance, and connected with the general economy of the plant, are assumed as furnishing the only ground that should determine their relations. Every plant stands by the side of those it most resembles, and if our classes and orders are not defined by well-marked limits, but gradually blend together on their outskirts, it certainly is not our fault, for we do no more than preserve those family resemblances,—in fact, copy that arrangement of the vegetable tribes, which nature itself has made. So plain and numerous are the affinities that exist between certain plants, that little botanical tact is required to discern them; they are evident at sight to the least practised observer. Every body can see this strong family likeness between the different species of the Grasses, and of the Palms, for instance, and would expect to find them, in a natural classification, arranged by the side of one another. Let us not be misunderstood; nature has instituted neither classes, orders, nor genera. She has done nothing more than to throw together the various members of the vegetable kingdom, in groups of more or less distinctness and extent. It is our business to ascertain and define the particular conditions on which their affinities depend. They must necessarily be less obvious in some cases than in others, but are not on that account the less real and strong. Inasmuch as traits of consanguinity between different men may be discerned in their moral and intellectual resemblance, when their features and complexion would never betray the fact, so to discern the affinities of plants and animals, we must often go beneath the surface,

and find, in more important parts of their structure, marks of relationship of the clearest and strongest kind.

This brief exposition of the objects of the artificial and natural methods of classification, will show well enough their several uses in the study of botany, and enable our readers to see that while both are indispensable, the latter cannot be neglected, without entirely overlooking the grandest views and deepest principles that the science contains. An exclusive attachment to the artificial method accustoms the mind to partial observation and superficial views; for as the attention is directed solely to the sexual organs, and that only for the purpose of finding the name of the plant, it is perfectly obvious, that much in its history must go unknown and unstudied. The very convenience and facility which it continually affords, incline the mind more and more to look at vegetables in a single point of view, and finally to regard this single object of finding their names, as constituting the whole science of botany. Incorrect notions relative to the nature of organs, and the force of characters, are insensibly imbibed; and while exaggerated estimates are made of the importance of some of these, most unphilosophical notions are entertained of the insignificance of others. In the natural method, on the contrary, not one, but all the organs pass under review, and are submitted to close examination, before the plant can be traced to its place in the general arrangement, so that the process of finding its name acquaints one with the most valuable points in its whole history. Instead of referring directly to the specific description, after a hasty glance at the stamens and pistils, the calyx, corolla, seed-vessel, seed, and general aspect are also considered; and thereby the student becomes better acquainted not only with the plant, but with a variety of properties which it possesses in common with a great many others. The study of affinities, when applied to particular species, necessarily throws light on other species; a knowledge of one constantly illustrating and increasing that of others. On the score of convenience, too, the artificial has but little advantage over the natural method, to one who is already acquainted with a considerable number of plants. In most cases he would hardly trouble himself to count the exact number of stamens, in order to ascertain its name, for the first glance would show him its affinities with others that he has previously examined, and consequently lead

him, at once, to its place in the natural system. Thus the relations that the plant possesses with other plants, and which form the most valuable part of its history, are already manifest before he has found its name; while he who neglects the study of the natural system is unable to advance a single step in the knowledge of the plant, till he is master of this fact. The decided and emphatic testimony in its favor of Linnæus himself, is a striking proof of the comprehensiveness and impartiality of his views, and is singularly contrasted with the misplaced jealousy of some of his disciples. He declares, 'that the natural method is the first and last object of botany;' 'that its fragments even should be diligently studied;' 'that none but poor botanists think it of little value;' 'that it is the highest aim of his own labors and of those of every accomplished naturalist;' 'that he had made some discoveries, and that the man who would remove his few remaining doubts, should be his *Magnus Apollo*.'

Many attempts have been made to arrange the vegetable kingdom according to a natural system of classification; but Jussieu was the first to develope its true principles and construct its foundations and frame-work, to be enlarged and completed by the labors and superior knowledge of succeeding botanists. Considering the immense researches that were required to bring the undertaking to any thing like a finished condition, and the disadvantages which naturalists of those days labored under, we have more reason to be surprised at its excellence than its imperfections, and feel constrained to look on it as one of the noblest monuments ever erected by human industry and genius in the great temple of nature. Many and important as are the changes it has suffered since its commencement, the impress of its original author is visible at every step, and time has not withered a single laurel that has been placed upon his brows. The fundamental principle of his system is, that all the organs and likewise all the points of view under which they may be considered, have not an equal degree of importance or permanence; that some control the others and necessarily determine their relations. It is this principle of the subordination of characters, first distinctly set forth by Jussieu, and now applied in the classification of every department of natural history, which drew from Cuvier the splendid and merited eulogium, 'that in the sciences of observation it created an epoch as important as the chemistry of Lavoisier in the

sciences of experiment.' To the development of this great idea, the labors of botanists have been principally directed in their endeavors to bring the natural method to the highest possible degree of perfection, and though genius and devotion have been brought to the work in no stinted measure, yet to Decandolle we believe is assigned the palm of undisputed preëminence. His *Théorie Elémentaire de la Botanique*, which contains a masterly exposition of the principles of natural classification, is the noblest contribution ever made to the Philosophy of Botany, and justly entitles its author to a place among the Newtons and Galileos of science. It is the production of a mind, that could dwell with minuteness on the smallest details without narrowing its range, and raise itself to the contemplation of the newest and boldest truths, without risk of yielding to the allurements of baseless hypothesis. If we are sometimes startled at the wonderful boldness and originality of his views, we are no less surprised, as we follow him in his course, to behold the caution and security with which every step to their attainment is effected, and are obliged to acknowledge in his reasonings the power of that logic of facts, in which no flaw nor sophistry can be detected. Ever treading on the utmost verge of truth, he never oversteps its confines to lose himself in the bewildering regions of theoretical speculation. His reasonings, though eminently acute and profound, are characterized by a remarkable simplicity, and presenting a noble specimen of philosophical induction, they proclaim their author a worthy disciple of the school of Bacon. Few are the naturalists, of whatever age or experience, to whom the pages of this work will not furnish through life, inexhaustible materials for study and reflection. As it is little known, however, in this country, and as little studied, we suspect, in England, we have thought we might do an acceptable service to such of our readers as are interested in Natural History, by presenting them not exactly an abridgment of its contents, but an analysis of its general principles.

The theory of natural classification consists essentially of three parts; which treat respectively of the comparative importance of the organs of plants, of the circumstances that may deceive the observer as to their true nature, and of the importance of each point of view under which an organ may be considered.

I. *Comparison of organs.* In order to ascertain the relative importance of the organs, it is necessary to compare them in reference to their functions. We say, for instance, that the brain holds a higher rank than the nerves, and the heart than the veins, but this does not decide the relative rank of the brain and heart. Or, to adduce an illustration of a different kind, a general is higher than a captain, and a governor of a province than the mayor of a town, but the arbitrary laws of etiquette alone decide, whether the general or governor be entitled to precedence. The first general principle in the classification of organized beings is, that the importance of each organ can be calculated only when compared with those organs, which relate to the same class of functions. In the vegetable organization there are two classes of functions, one destined to the preservation of the individual, the other to that of the species. These, no doubt, are of equal importance, and always possess corresponding degrees of perfection. Hence, we deduce another general principle of classification, viz. that systems, established upon either of these two grand classes of functions, would be equally natural, provided they were constructed with the same care. The preference, indeed, has been usually given to the reproductive organs, because differences in the vegetable organization are more perceptible in them than in the nutritive organs, and more especially too, because the latter have been comparatively but little studied. Were they both equally well understood, without doubt a system founded on one, would be identical with one established on the other; for every thing leads us to believe, that any complication, or other modification in one class of functions, is attended by a similar one in the other. Cesalpinus had established certain classes upon the structure of the embryo alone, many centuries before Desfontaines was conducted to the same result by making use of the nutritive organs. Hence also we make the division of plants into Monocotyledons and Dicotyledons with so much the more confidence, because we are equally led to it, whether we assume as the basis of our reasonings, the reproductive or nutritive organs. In order to estimate the importance of each organ in a given function, we must ascertain what is essential to its performance, when reduced to its simplest conditions. Thus, the essential part of reproduction is fecundation, and the fecundating organs are con-

sequently of higher importance than all their envelopes. At first, the sexual organs are equally indispensable, but the duty of the male parts is of short continuance, and they, together with a portion of the female parts, are destroyed after fecundation. But as the female organ, beside this short-lived part, includes another for which all the rest are constructed, its importance is obviously greater than that of the male. Again: in the part of the female organ that remains, the integuments or fruit may be separated from the seed, and exist but for it. The seed has thus a higher value than its envelopes; and continuing the same reasoning, we at last find the embryo performing the most important part in the whole function of reproduction. If, now, our conclusions be just, the organs may be arranged, in regard to their relative importance, in the following order. 1. The embryo, the great end of all the rest. 2. The sexual organs, which are only the means. 3. The envelopes of the embryo, viz. the integuments of the seed and the pericarp. 4. The envelopes of the sexual organs, viz. the corolla, calyx and involucre. 5. The nectaries and other accessory organs.

Another means of judging of the relative importance of organs, is by the degree of constancy with which they appear in the vegetable organization. Some, we know, are frequently absent, some, not so often, while others are almost always present. Hence we infer, that the stamens and pistils have a higher rank than the calyx and corolla, and these latter than the nectaries; the filaments of the stamen and pistil are thus shown to be of less consequence, than the anthers and stigmas.

A third means of judging is, to observe to what point a given organ is more or less intimately connected with the structure of certain groups, already acknowledged by naturalists. Thus, we conclude that stipules are more important than spines, because a great number of families either have or have not stipules, while there are many in which we find indifferently species with or without spines.

II. *The circumstances that may deceive the observer as to the true nature of the organs.* Before we can decide any question as to the relative importance of the organs, we need some means of distinguishing the organs themselves, and recognising their true nature, under all the modifications they are liable to experience. Looking at a single organ abstracted from the general structure, we can judge of its nature solely by its use,

whatever may be its position, form, or mode of action; thus, the organ of vision is called the eye, and the part that bears the flower is called the peduncle. But when we examine beings as a whole, and judge of the nature of the organs in reference to the symmetrical plan on which they are constructed, this method will lead us into grievous errors. The tail of the kangaroo serves the animal as a leg, yet nobody denies that it is still a tail; the nose of the elephant, prolonged to a great length, performs the office of a true hand; and the teeth implanted in the incisive bone, serve a purpose entirely foreign to mastication, yet none pretend to dispute the anatomical analogy of these organs with the nose and teeth of other mammifers. So too, we see the leaves of plants sometimes prolonged and changed into tendrils for the purpose of supporting the stem, though their primitive function is to elaborate the nutritious juices. The stipules, the peduncles, and even the lobes of the corolla may be converted to the same use, and every body is familiar with the leafy appearance and structure of the branches of the Indian Fig, or Prickly Pear, (*Cactus Opuntia*). From these examples and a host more that we might mention, we deduce the general conclusion, that it frequently happens, in consequence of a given system of structure, that a certain function, not being sufficiently performed by the organ ordinarily allotted to it, is discharged wholly or in part by another. It is this system of organization, this symmetry of the organs as compared with one another, of which a knowledge is essentially necessary to a perception of the general harmony and natural classification of beings. This symmetry of parts, which should be a prominent object of the naturalist's studies, is, in one word, the result of their relative disposition; and therefore, whenever this disposition is the same, no matter how various may be the form of particular organs in other respects, the subjects present a kind of general resemblance, that strikes the least practised eye.

Among the causes of error that are liable to mislead us in ascertaining the true nature of the organs, the principal is *abortion*, more or less complete, which alters their symmetry. Every body knows, that sometimes certain parts of organized beings do not receive that increase and development for which they were evidently destined, owing either to the compression of a foreign body, or a loss of part of their nourishment. This

effect may be produced by internal causes, such as *caries*, for instance, as well as external; but among those which prevent certain organs from receiving their full increase, it is possible that some may be the necessary consequences of the growth of another part, and will, of course, constantly occur in a given system of organization. We may, therefore, admit in theory the constant and predisposed abortion of certain organs, either wholly or in part. This is a startling doctrine to those yet uninitiated into a knowledge of the more hidden laws of organization, but is, nevertheless, as easy of proof as an abundance of the clearest facts can make it. Whoever will take the trouble to cut across the ovary of a horse-chestnut flower, soon after the petals have fallen, will find three cells and two seeds in each cell; but let him look a few weeks afterwards, when the fruit has attained its perfect growth, and three seeds or nuts are the most that can ever be found,—sometimes but one. But to remove all doubt as to the fact and nature of this phenomenon, we have only to cut open an ovary every day after the period of flowering, to see some of the seeds gradually increasing, while the others are observed to remain stationary, and finally to be completely choked by the development of the first. Now, when we bear in mind that this phenomenon is constant and takes place in trees perfectly sound, are we not forced to believe, that it is owing to some circumstance in the very system of the organization of this tree? In the oak, too, we have another familiar instance of a three-celled and six-seeded ovary finally resulting in one perfect seed only. The disappearance of the sexual organs is a very common occurrence, of which an example may be witnessed in the marginal florets of the snow-ball genus, and many other plants whose flowers grow together in large masses. The question then recurs, how shall we recognise the general symmetry of plants, amid the confusion produced by these partial abortions? Some light may be obtained on this point from observing appearances denominated *monstrous*,—an epithet commonly given to all such as differ from the habitual state of the organs, though many of them are returns of nature to the symmetrical order. Thus, to recur to an example already cited, if, by some accidental cause, the six little seeds of the horse-chestnut or oak should obtain their full growth, and present us with a fruit of six nuts or acorns, we should call it monstrous, while, in truth, it is the single-seeded fruit

that is the real monster. The Antirrhinum or Toad-flax has a personate corolla, the lower segment of which sends out a long spur, with four stamens of unequal length, and the rudiment of a fifth. In a variety of this plant called Peloria, the flower is perfectly regular, having an equal five-lobed corolla sending out five equidistant spurs, in which are five equal stamens. Here is a most singular case of a return of nature to her favorite symmetry, and no doubt can be left as to which is the real monster. The rare example of certain compound flowers, where we see the egret become leafy and assume the appearance of a true calyx, is a strong proof of the egret's being, in fact, an abortive calyx. It is well known also, that trees which have spinous branches in a dry soil, cease to have them in a fertile one,—a sufficient proof that spines are abortive branches.

Another guide, less sure perhaps, but adapted to more general use, is analogy or induction. It is found solely in a knowledge of the respective positions of organs. In an Albuca, for instance, we find the entire structure of a liliaceous plant, excepting that it has only three stamens bearing anthers, while between them we observe three filaments placed precisely where stamens would be, and very similar to the existing stamens. Hence, we conclude that these filaments are abortive stamens. In the Ice-plant (Mesembryanthemum,) we find a great number of filaments disposed in several ranks, but all adhering by their bases, and attached to the same point of the calyx, the interior bearing fertile anthers, the middle having the anthers wholly or in part abortive, and the exterior being true petals. We conclude then, that in this genus, the petals are naturally abortive stamens, and from a crowd of similar facts we are led by a very powerful analogy to the belief, that the petals of all plants, as a general theorem, are only filaments of stamens, whose development is in the relation of cause or effect to the abortion of the anther. When too we see the calyx of a Valerian or Scabious evidently assuming the form of an egret or pappus, we are induced by analogy to extend this result to the compound flowers, and conclude that *their* pappus is only an abortive calyx. Finally, by analogy alone, we judge in a host of cases of the natural number of the parts of flowers and fruits, and are led to look carefully for those whose abortion we suspect. It is the successful use of this principle which, more than any thing else, facilitates the

study of nature, while the number of its objects are daily increased by discoveries, and constitute in fact, the true genius for Natural History.

The proximate cause of abortion is principally defect or excess of nourishment, and it may be well to consider a little farther the operation of these causes; and first, the effect of abortion by defect on the organ itself. When partial, it gives rise to inequalities between organs naturally similar, and this is the principal if not the only cause of the irregularities presented in the structure of vegetables. Every thing which has any bearing on this subject, goes to establish the conclusion, that all organized beings are regular in their intimate nature, and that abortions, variously combined, produce all the irregularities that arrest our observation. In this point of view, the slightest inequalities between organs of the same name in a plant, are important, because they tell us in language plainer than words, that we may find analogous plants where this inequality is still greater, and others where these organs, thus subject to partial abortion, have entirely disappeared. It may be received as a general principle, that wherever, in any given system of organization, there is inequality between organs of the same name, this inequality may attain its maximum, viz. the annihilation of the smallest part. When the abortion of an organ has proceeded so far as to prevent it from discharging its functions, it may be enabled, by this very circumstance, to fulfil some other functions. The abortion of the extremity of the leaf in vetches renders this part capable of performing the functions of a tendril, and abortion of the flowers of the Vine turns the peduncle to a similar use. In the same way, branches are changed into spines, and serve as defences to the plant, and the calyx of compound flowers into a pappus, which is useful, not more to the protection of the sexual organs, than the dispersion of the seed. It may happen, however, that an abortive organ, having lost the power of performing its proper function, never becomes adapted to any other, and remains without any manner of utility in the plant. In a multitude of vegetables, we find abortive stamens and pistils reduced to simple filaments or stumps, and evidently useless. Petals are sometimes found so small that they can hardly be discovered, and cannot protect the sexual organs. What purpose can those florets of certain compound flowers serve, which are invariably sterile? In the animal kingdom, the nipples of

males, the rudiments of clavicles in the Cats, and of digits in the Ruminants, present us instances of a similar kind. These useless parts are the result of the primitive symmetry of the organization, and so far is their existence from being an argument against the general order of nature, that it furnishes one of the most striking demonstrations in its favor.

Finally, abortion may be so complete as to leave no trace whatever of the organ. Sometimes, it may be discovered, as in the seed of the oak, in the earliest periods of its existence, and observed to be gradually diminishing, while, in other cases, the organ is never found in any stage of growth. Here abortion is determined by causes so remote, that it is completed before it could be visible to us, although it may nevertheless have once existed. To illustrate this idea, let us suppose a branch of a palm, cut open from top to bottom, and our attention directed to the bunch or cluster in the centre of the section near the top, which is destined to expand the following year, then, a little lower down to the one that is to expand the second year, below that to one of the third year, and so on till we arrive at that which will expand seven years hence. Now, in certain palms, there is an entire abortion of some parts of the flower, and though this part may never be visible when the flower is developed, yet no one can deny that it may have existed in the bunch of the proximate year, or in one of the following, and that with the aid of proper instruments we might have discovered it. These abortions, like others, may be accidental or natural: when the former, we may observe the part unaffected by abortion in other individuals of the same species; when natural, predisposed as it were by the march of vegetation, we recognise the abortion only by the analogy of neighboring species. The effects of abortion on other organs will differ according to the degree to which it is carried. If it be considerable, or if the nourishment be thrown upon organs of a more variable nature, there results, not only a change of size, but of function. In double flowers, which present a remarkable example of this kind, the abortion of the anthers permits the filaments to be developed beyond measure, and become transformed into veritable petals. All that has been said of abortions by defect is equally true of abortions by excess, but in an inverse sense; and thus, while one necessarily produces the other, and both exist together, it is impossible in most cases to determine which is the cause, and which the effect. Resuming now the imme-

diate consequences of this theory of abortion, we see in it, first, an explanation of a multitude of anomalies in the number of the parts of plants; secondly, of many, perhaps all, the inequalities of proportion in similar parts; thirdly, of the changes of form, and consequently of use, so frequent in organization, and incomprehensible without this theory.

The next source of error to be considered, is the *adhesion* or *engrafting* of organs. Every body knows that a bud or shoot, placed upon another tree under certain conditions, is united to it in such a manner as to form a part of it and grow as if it were on its own stem. Every body knows, too, that in forests we find trees of the same or analogous species, which having been accidentally approximated, are united together so as to form but one trunk, and many have observed that certain organs of plants, that have been brought near one another, are united in a most intimate manner; that two neighboring flowers may be so united as to form but one, having a double number of parts, and that two leaves may also adhere together, so as to form but one of a singular shape. So long as these adhesions take place rarely, they are considered, and justly too, as simple accidents, and no importance is attached to them in classification. But let us suppose that two ovaries, for instance, stand very close to each other from their origin, as in the case of the Pigeon-berry, (Mitchella Repens); it is clear, that by reason of this approximation, the opportunity of coalescing is so great, that union will always take place and we shall never see them separate. Now, this adhesion is nothing more than an *accident*, but it is one which is determined by causes belonging to organization, and as constant as the organ itself, insomuch that we have what may be called a constant accident, and though these terms seem contradictory, this kind of phenomenon is still very common in nature.

Not only may similar organs be primarily disposed in such a manner as not to be able to grow without adhering together, but the same thing takes place in different organs; and it is remarkable, that while this phenomenon has been recognised under certain circumstances, it has, in analogous cases, been entirely overlooked or denied. Any organ, a calyx or corolla, for instance, may be described in two ways; either analytically, by considering it as an unique whole divided into parts more or less distinct, or synthetically, as an aggregate of parts essentially distinct, but more or less approx-

imated or united. In the first method, we are bound to render an explanation of the causes and laws of the separation of the parts; in the second, to give a similar explanation as to their approximation or union. Both methods involve some hypothetical considerations, and yet, we must follow one or the other. If we are describing a Hollyhock, we must either regard the corolla as an unique whole, divided into several portions called petals, or the petals as distinct organs, which by their union form the corolla. Each of these modes of reasoning may possibly have some good foundation, but certainly it cannot be right to adopt one in the case of the Hollyhock, and the other, when treating of a different flower. We must be consistent, and a method being once admitted, it must be adhered to in all analogous cases. The phenomena of crystallization, to borrow an illustration from a neighboring science, were explained by Rome de l'Isle, by considering crystals as integral bodies, which, in consequence of different truncations, assume all the secondary forms. The Abbé Haüy, on the contrary, explained the same facts, by supposing primitive molecules, which, aggregating after particular laws, determine all the secondary forms. Either theory may be adopted, though the former is now abandoned; but what would be thought of a mineralogist, who should describe one crystal after Rome de l'Isle's method, and another, after Hauy's? And yet, such is the state of botany, that this is constantly done in regard to that science. It becomes, therefore, a matter of serious inquiry, which of these two methods best expresses the whole of the facts, and whether there be cases where they may be blended together. When we speak of the perfoliated leaves of the Honeysuckle, the idea meant to be conveyed is, that an unique or orbicular leaf is traversed or enfiladed by the stem that bears it, yet no one at the present day hesitates to consider this pretended perfoliated leaf as composed of two opposite leaves united at their base. In precisely similar cases we use the term *connate* leaves, which expresses nearly enough the idea of union; we follow all its degrees from the slightest to the most intimate kind, and when we perceive an interval towards the point of junction, we still consider it as two leaves imperfectly united, not as an unique leaf deeply gashed. The reason is, that at the base of the plant the two opposite leaves are separate and distinct, and that as we approach the summit, they tend more and more to be united; that we find

each half of the perfoliate leaf unique in appearance, and possessing all the organization of one of the inferior leaves. Thus, though the phenomenon is constant, no one hesitates to consider it as a kind of accident, determined by the organization itself.

The law here recognised is applicable to every case of connate leaves, and we must admit the general conclusion, that as leaves may adhere together accidentally, there are cases in which this phenomenon occurs constantly, in consequence of their nature and position. All that has been said of leaves must be readily admitted of stipules, which resemble them so closely; so that when we see all the Leguminosae having a stipule on each side of the petiole, we may conceive that, if these two stipules should be so large as to touch on the side farthest from the petiole, they might be united, and consequently assume the appearance of an unique stipule opposite the leaf. The involucres, too, are subject to the same law of adhesion, as might readily be supposed from analogy, since these organs are now universally regarded as only assemblages of floral leaves. In the Umbelliferae, the involucre generally consists of a certain number of whorled and separate leaflets, but in some species of this order, there is found instead of this whorl, a leafy disk, presenting as many teeth and furrows, as there are leaflets in the neighboring species. We are therefore constrained to regard this disk as formed by the natural union, more or less complete, of many leaflets, and not as a single-leaved involucre. If then the leaves and involucres be so readily regarded as subject to this law of adhesion,—of the union of several distinct parts into one,—why should not the fact of its operation be admitted in regard to the calyx? This organ resembles the involucre in every respect; the anatomy of the sepals shows that they are entirely leafy organs; they are green and decompose carbonic acid like the leaves; they are almost always furnished with the same hairs, glands, and sacks as the true leaves, and finally, in a multitude of cases, accidental or habitual, we see them developed into true leaves. If then the calyx is of a leafy nature and so very analogous to the involucre, why describe it on a diametrically opposite plan? Why consider it as a unique organ, more or less divided, instead of saying, as in the preceding cases, that it is formed of pieces more or less united together? Besides, the latter method involves no more hypothe-

sis than the former; since, in a very considerable number of plants, the sepals are completely distinct from one another, and even attached separately to the peduncles. It is best supported too by their anatomy, for all the nerves of the calyx are directed from the base to the summit, as in leaves, though constantly described as if they proceeded from the summit to the base, and since all modern botanists admit the union of the calyx to the ovary, it would be strangely inconsistent to imagine, that the sepals could not be united as easily to one another as to a foreign organ. Instead of saying of a calyx, that it is deeply cleft, the most proper language obviously is, that the sepals are united only at the base; instead of describing it as lobed and toothed, the sepals should be considered as united half or more of their length; instead of distinguishing calices into polysepalous and monosepalous, we are bound to use the distinctions of polysepalous, or free sepals, and gamasepalous, or sepals more or less united, and reserve the term monosepalous for the rare cases, where there really exists but one lateral sepal.

The same reasoning, the same analogies are applicable with perhaps still greater force, to the operation of the same law upon the corolla. This is not an unique whole, more or less divided, any more than the calyx, but an assemblage or whorl of petals, sometimes perfectly free and sometimes more or less united. In many cases this union is in a manner manifest to the eye, while in others, it is indicated by the disposition of the vessels; where it is not thus visible, and the tubes are continuous, it may be conjectured by analogy, and by the insensible gradations to be observed between corollas with petals entirely free, and those with petals united. The corolla of the clover is formed of but one piece, instead of four separate and distinct petals, as in all the rest of the Leguminosae; yet who, on that account, would deny its analogy to that order, and that it differs only in the natural adhesion of its petals? Adopting the ordinary way of distinguishing corollas into monopetalous and polypetalous, we must suppose an organization entirely different, for what analogy is there between a flat petal associated with several others in a whorl, each attached to a single point, and a circular tubular petal, with many points of attachment and a sinuated margin? Such a fact can be considered as hardly possible, when we recollect how many families there are, in which we see plants with monopetalous

and polypetalous corollas, indiscriminately mingled together. And what are we to make of those corollas, whose pieces, as in the vine, are separate at their base, but united at the summit? This reasoning becomes still more striking, when we consider the light in which stamens have been viewed. These parts possess an extraordinary analogy to petals; their point of attachment is constantly the same; their number and position are generally symmetrical; the anatomy and physiology of the filament of the stamen is perfectly similar to that of the claws of the petals, and in some flowers, they pass into each other by such insensible gradations, that it is impossible to say where one begins and the other ends. This being the case, we ought certainly to expect that the same mode of reasoning in regard to the adhesion of one should be equally applicable to that of the other. Now, however much the stamens may be united together, they never are considered in the light of an unique organ, divided more or less deeply into several parts, but always as separate and distinct organs, united according to the law of adhesion. But is this union of the filaments any more apparent than that of the petals? Are not the two phenomena equally constant in the same species? Are any more evident traces of it left in one than in the other? These two organs are of the same nature, and we must either consider the whorl of stamens as an unique whole, deeply cleft, or the whorl of petals as formed of many pieces more or less united. What would be thought of a zoölogist, who should describe the feet of the web-footed birds as orbicular disks, divided to a greater or less extent? All naturalists regard them as distinct digits, united by a membrane, and this manner of considering organs as compound bodies, is the only one that represents the natural state of things,—the only one that admits of clear expressions and exact comparisons.

The truth of this theory becomes still more manifest, when we attend to the manner in which petals adhere at their base. In a polypetalous flower we see that generally each petal is fixed at its base by a fibre which carries its nourishment, and that if its base be very large, the rest adheres only by cellular tissue. Every family has thus a certain disposition in the vessels of the petals, and it is always the same, whether they be united or not. This analogy is equally striking, when considered in another point of view. Petals are composed generally of a claw and limb, as stamens are of filament and anther, and

adhesion ordinarily takes place by beginning at the base and finishing at the upper part, so that most petals, when they unite, adhere by their claws while the limb is free. In the same manner, most adhering stamens have the filaments joined and the anthers distinct.

We come now to the pistil, or what, in this relation, is the same thing, the fruit. In the Ranunculaceae, we generally find the fruit composed of a considerable number of partial carpels, united in some species only at their base, in others half their length, in others, nearly to their summit. Hence, no conclusion can be more natural than that ovaries, apparently unique but divided internally into many cells, are in reality formed by the constant and natural adhesion of many carpels. Sometimes the partitions between the cells are formed by the reëntering valves, the carpels being plainly united by their lateral faces,—a fact which beautifully illustrates this theory. We would say more on this point, but as it would be difficult to render our language intelligible to any but practical botanists, we are reluctantly obliged to dismiss thus briefly the most interesting among all the discussions on this subject.

If the above reasoning be correct, it appears that the adhesion of different organs takes place as a necessary consequence of primitive contiguity, constituting what is called *predisposed adhesion*. It is easily conceived that it may mislead us in regard to the number, position and nature of the organs, and that it constitutes a subject of considerable importance in classification. Every case of adhesion cannot be of equal consequence, and we are therefore led to adopt the following general rules for guiding our inquiries on this point. First, the adhesion of the different organs of fructification is so much the more important, as it takes place between parts in which this operation is most difficult. Secondly, the adhesion of these organs is so much the more important, as it is necessarily connected with the greatest changes in the general symmetry. Thus the union of the petals and stamens, of the filaments and styles, of the anthers and stigmas, of the ovary and calyx, in consequence of the great anatomical similarity of these parts, are phenomena of easy and frequent occurrence, and therefore of no great importance; while for the very opposite reason, the union of the corolla and calyx, of the stamens and calyx, of the corolla and ovary, must be regarded as instances of adhesion of the highest importance.

We are not to suppose, however, that whenever two organs adhere together, they necessarily preserve all the parts of which they were originally composed. When two labiate flowers are united, we rarely find eight stamens, but seven, six or only five, and instead of ten lobes, their corolla may present indifferently all the numbers between five and ten. In fact, the union of two regular flowers is seldom recognisable except by an augmentation of the number of their parts, some of each being lost by abortion. This theoretical consideration may be applied, in many cases, for the purpose of recognising the affinities of certain plants. The Cruciferae, for example, have naturally four petals and six stamens, which inequality in the number of parts indicating a loss of the original symmetry of the flower, we wish to determine, whether they are related to plants whose number of stamens is double that of the petals, or to those where these numbers are equal. If to the former, we must suppose them in their primitive state to have had eight stamens, two of which have aborted; if to the latter, that each flower is originally composed of four petals and four stamens, but that they grow in threes, and that there is a union of the three flowers with an abortion of the lateral ones, excepting a single stamen in each. This latter hypothesis implies a more complicated operation than the former, but still appears to approach nearer the truth, for cases have been found where the flowers possessed four petals and four stamens, and where, in place of the two lateral stamens, there was on each side a flower with the same number of parts. We are still farther confirmed in the belief that this is the primitive state of the Cruciferae, because the position of the two lateral stamens is always below that of the others, because they are very constantly wanting in many species, and because the Hypecoum, the only genus with which the Cruciferae have any marked relation, has four stamens and four petals. This single case must suffice to show the practical application of the theory of abortion and adhesion, in unravelling the natural affinities of plants.

III. Having now exposed the principal difficulties in the way of recognising the symmetry of the organs, we shall show very briefly, in what this symmetry and the comparative value of its elements consist. The most important of these elements is the existence or absence of organs, and on this point, we must beware of some powerful causes of error. Two organs

really existing may be so united and assume such an appearance, that the presence of one becomes problematical. Thus, the union of the calyx and corolla has given rise to the idea that one or the other of these organs is wanting in plants, where both really exist, and the union of the pericarp and spermoderm has sometimes induced the belief, that the seeds had no proper envelope, or that the pericarp was wanting. Certain organs may fail also, in consequence of abortion; and it is only by means of an acquaintance with the general symmetry of the plant, that we can distinguish between this phenomenon and that, where the organ is naturally wanting.

After the presence or absence of organs, the next most important element of their symmetry is their absolute and relative position, for here we expect the greatest and most permanent difference. The essential position of a particular organ must be determined in relation to that which serves as its real support, that is, from which it receives its origin and nourishment, and not organs foreign to its existence. This it is frequently very difficult to recognise, but their relative position, though less important, may be oftener and more surely employed. In all vascular vegetables, which comprise all with whose symmetry we are acquainted, we remark that their organs are placed relatively to one another in a general order. In the flower, the pistil occupies the centre, and the stamens, petals and sepals, composed of a certain number of parts, are disposed around the pistil according to different symmetries. They may be placed directly before or alternate with one another; they may correspond with the parts of the pericarp, or have no relation whatever with them. These different combinations possess considerable importance in classification, provided that we avoid the two sources of error already exposed, adhesion and abortion, which, by diminishing the number of the parts, conceal their true symmetry. Thus, it belongs to the symmetry of the Leguminosae to have the petals alternate with the sepals, but if the two inferior petals be united, or if one of the petals prove abortive, the number is reduced, and the symmetry is masked to the eyes of the superficial observer.

The absolute or relative number of organs is a character, whose importance has been very differently estimated, but which, like many others, varies under different circumstances. The absolute number of organs is liable to be modified by a variety of causes, such as abortion, adhesion, &c., but where

all these sources of error are avoided, we cannot deny that this character is one of considerable importance, though subject to certain conditions. We may say, first, that the absolute number of organs in every plant is generally more fixed, and consequently so much the more important, the smaller that number is; secondly, that unity never exists naturally in any of the reproductive organs, except the pistil,—whenever they are found single it is the consequence of abortion or adhesion,—and in the conservative organs, unity of the leaves exists only in the Monocotyledons; thirdly, to ascertain the true absolute number of organs in a plant, it is necessary to go back, by means of the theory of abortion and adhesion, to the number that appears to be the primitive type of the class, or to one of its multiples. The numbers 4, 5, and their multiples seem to belong to the Dicotyledons, and 3, with its multiples, to the Monocotyledons, while 2 and its multiples are very permanent among the Acotyledons. Characters drawn from the relative number of organs, that is, from a comparison of the proportional number of the parts of the different systems of a compound organ, may be relied on with considerable confidence. Thus, the absolute number of stamens in the Epilobium is 8, the relative number twice that of the petals. Under this point of view, we are obliged to distinguish between *multiple*, *determinate*, and *indeterminate* relations. An instance of the first we have in the Epilobium, where the parts of the calyx are 4, corolla 4, stamens 8, and pistil 4; of the second in the Violet, where the parts of the flower are as 5 to 3 compared to those of the pistil; of the last, in the Magnolias, where the number is not fixed in the petals, stamens, or pistils. If now abortion take place in all the four systems of a flower at once, their relative numbers may remain the same, while their absolute number will be changed; but how are we to distinguish between these two kinds of numbers? If we consider that when a single system is altered, the flower becomes necessarily irregular, and that in all cases, where every system is affected at the same time, it remains regular, we arrive at a simple and exact theorem: viz.—In all regular flowers, the relative number of the parts of each system should be the first object of our research; in all irregular flowers, we begin by ascertaining the absolute number of each system, and thence deduce their relative

numbers. When one or more parts of a system are so numerous as to present many ranks, the relations of number, though still existing, are difficult to be perceived, though by care and diligence we may sometimes find them. An oriental Poppy has been observed, which had 3 sepals, 6 petals, and 564 stamens, that is, 94 ranks of 6.

The next element of symmetry to be considered, is the absolute, relative and proportional size of the parts; and here we may compare together, in regard to size, two systems, or their parts. The proportional dimensions of the parts of a system are frequently a matter of great interest, for the whole study of irregular plants, and consequently, the whole art of referring them to the regular symmetries of which they form a part, rests upon the examination of the inequality of the parts of a system. The fundamental principle of this examination appears to be, that among vascular, and perhaps among all vegetables, the parts of the same system are naturally of equal size, and become otherwise only in consequence of phenomena, more or less intimately connected with the general structure of the plant. The causes of these phenomena we are not always able to specify, but the position of the flower on the stem undoubtedly determines a great many inequalities. When solitary, erect, and terminal, it is equally nourished, and will of course be regular, insomuch that it may be considered as an unexceptionable general law, that flowers thus situated are regular, even when they belong to a family ordinarily irregular. If other flowers spring up around it, forming a head, their equilibrium is disturbed; those in the middle, being equally pressed, will become abortive or change their form, though still continuing regular; the lateral ones, being unequally pressed by their neighbors, will have a tendency to increase on their external side, where the pressure is least. All families with a peculiarly irregular flower, are never observed to have the flowers terminal, always having them axillary, or disposed in a spike or cluster. Sometimes, in the Labiatæ, we find terminal flowers, but then they are always regular. An important result of these considerations is, that since the primitive symmetry of each system may be deranged by accidental causes, it becomes necessary, before we can establish a good classification, to trace back all irregular plants to their primitive and regular types, though these types may be rarely encountered, and sometimes

are even ideal. Thus the Personatae are found to be only alterations from the type of Solaneae.

We have thus exposed very briefly the principles which determine the comparative importance of organs, and the method whereby we may graduate the degree of importance, presented by the different points of view, under which each organ may be studied. It is also requisite to show how these two modes of reasoning may be combined, or in other words, how we are to arrive at a proper appreciation of characters; for a character, in fact, is one manner of considering organs generally, applied to one in particular. As a general rule, the value of characters is in a ratio composed of the importance of the organ, and of the point of view under which we may consider it; so that characters, drawn from a particular organ, will have a value proportioned to that of the modification, and when drawn from the modification, it will be proportioned to the importance of the organs. Though the organs have different degrees of relative importance, yet the value of characters drawn from them will depend on the importance of the modification, for a very trivial one in a very important organ may furnish a character of less consequence, than a greater in a far less important organ. The results of the combination of these two elements will be equal or unequal. They will be equal, first, when the same modification is common to two organs of the same physiological rank; secondly, when two modifications of the same rank exist in one or two organs of the same rank; thirdly, when the importance of the organ is counterbalanced by that of the modification. Thus, if we compare the sensible qualities of the embryo, the highest of all the organs in the scale of importance, with the existence of the nectary; or in other words, if we compare the least important modification of the most important organ with the most important point of view under which the least important organ can be considered, we shall have two analogous results, as theory and observation both testify.

Here we must close our notice of the *Théorie Elémentaire.* Though many points have been left untouched, and though we are sensible that general principles must lose much of their force and clearness when presented without the proper illustrations and discussions, yet we trust that a worthier idea of philosophical botany has been conveyed, than is generally obtained

from the common books on this science. The want of a work, in which the principles of the natural system should be made accessible to the English student, and which is capable of a practical application in the examination of plants, has long been painfully felt by those, whose attainments, though limited, are still sufficient to make them aware of the deficiencies of the Linnaean school, but who have no means of becoming acquainted with more enlarged and philosophical views. All our Floras and similar works, to which the botanical student is referred for the description of plants, are arranged according to the sexual method, and not a word perhaps meets his eye concerning their natural relations. In our schools and academies, the science, we believe, is taught in a similar spirit. The organs of fructification are pointed out in such a manner that they may be recognised under the most ordinary conditions, while the structure of the seed, and its changes during growth and germination, and especially the laws of the variation of the organs, are about as little regarded as if they never existed.

An attempt was made a few years since to supply the deficiency in question, by Sir James Edward Smith, in a work whose title we have quoted at the head of this article; but which does not, in our opinion, merit the reputation it has acquired in this country and abroad.

From this, we turn with satisfaction to the 'Introduction' of Professor Lindley, which, though it may not have accomplished quite all that we could have wished, will prove an invaluable work for the young student, for which he can never feel too thankful. A vast amount of information relative to the natural orders is here brought together from a multitude of sources, systematically arranged, and agreeably disposed. 'The plan adopted,' to use the author's own words, 'is this: To every collection of orders, whether called class, division, subdivision, tribe, section, or otherwise, such remarks upon the value of the characters assigned to it are prefixed, as the personal experience of the author, or that of others, shows them to deserve. To every order the Name is given which is most generally adopted, or which appears most unexceptionable, with its Synonymes, a citation of a few authorities connected with each, and their date: so that, from these quotations, the reader will learn at what period the order was first noticed, and also in what works he is to look

for further information upon it. To this succeeds the Diagnosis, which comprehends the distinctive characters of the order, reduced to their briefest form, and its most remarkable features, without reference to exceptions. The latter are adverted to in what are called Anomalies. Then follow the Essential Characters; a brief description of the order, in all its most important particulars. This is succeeded by a paragraph styled Affinities, in which are discussed the relations which the order bears to others, and the most remarkable circumstances connected with its structure, in case it exhibits any particular instance of anomalous organization. Geography points out the distribution of the genera and species over the surface of the globe: and the head Properties comprehends all that is certainly known of the use of the species in medicine, the arts, domestic or rural economy, &c. A few genera are finally named, as Examples of each order.' We have no fault whatever to find with this *plan*, but it certainly appears to us, that the account of the Properties is disproportionately long; especially in a work like this, to most of the readers of which it must necessarily prove the least interesting portion of the work. Medical Botany is too important a branch of knowledge, to be treated of at great length in a work which has a far different design in view. We could have wished, that much of the room occupied by this head had been given to that of Affinities; for the valuable extracts from Decandolle, Brown, and some others, with which the latter is enriched, have made us regret that they were not even more numerous. The writings of botanists who have illustrated the affinities of plants are so scattered over periodical journals, transactions of societies, and other works, that they are almost inaccessible to the young student, particularly in this country, where these works are rarely seen.

The introduction, besides some remarks on the comparative merits of the different systems of classification, contains a short exposition of the organs of plants, as they are understood at the present day; but as this is insufficient for the proper understanding of the work, the American editor has very judiciously prefixed an excellent treatise published by Professor Lindley not long since, entitled, *An Outline of the First Principles of Botany*. It may be considered an epitome of vegetable organography, divested of all theoretical considerations,

and expressing only such views as are well established by observation. In conclusion, we cordially thank Dr. Torrey for his agency in the re-publication of this work, for we trust it will give an impulse and direction to the study of botany which it has yet to receive on this side of the Atlantic.

Art. III.—*Story's Constitutional Law.*

Commentaries on the Constitution of the United States; with a Preliminary Review of the Constitutional History of the Colonies and States, before the Adoption of the Constitution. By Joseph Story, LL. D., Dane Professor of Law in Harvard University. In three volumes. 8vo. Boston. 1833.

It would be impossible to write any thing which could properly be called a Review of this work, in much less compass than that of the work itself.—It is in fact a Review of the Constitution, preceded by a sketch of the Constitutional History of the States, before the Revolution. This introduction contains, in outline, the civil and political history of each of the American Colonies and Provinces, with indications of the peculiarities and varieties of their legislation. This is succeeded by the history of the Revolution, the formation, decline and fall of the Confederation, and the adoption, and general character of the Constitution. On this follows what properly forms the substantial portion of the work;—viz. a complete Commentary on the entire Constitution of the United States, in all its parts. It is obvious, that it embraces a vast number of separate topics; a great amount of historical facts; and a long succession of the most important discussions. The work, properly used, with a diligent and faithful resort to the authorities cited, amounts to a digested course of reading on constitutional law; and the student, well possessed of its contents, would need nothing farther in this great department, than that which the active and discriminating mind must elaborate itself, in order to make any study profitable.

It is a question that unavoidably presents itself, now we have the book, How we did without it?—It is evidently such